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(54) **An apparatus for distributing powders on a support in a predefined pattern**

(57) The apparatus for distributing powders on a support (2) in a predefined pattern comprises: a conveyor belt (1) for transporting the support (2); an applicator head (3) for applying the powders, located above the conveyor belt (1), which head (3) comprises a belt (4) exhibiting a plurality of perforations set out according to

a predefined pattern and being of such dimensions as to allow passage of determined quantities of the powders; means for controlled supply of the powders to the head (3). The motion of the perforated belt (4) is correlated with a motion of the conveyor belt bearing and supplying the support (2).

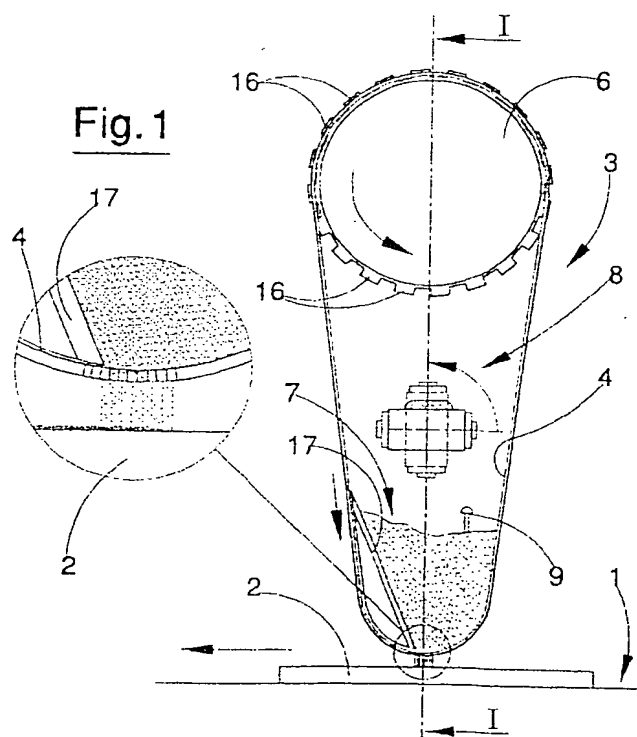


Fig. 1

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Description

[0001] Especially, though not exclusively, the invention is useful in the production of ceramic tiles.

[0002] More specifically, it can be used: for dry decoration using powders on already-pressed tiles on traditional glazing lines; for dry decoration using powders (atomised or otherwise) on a still-soft support, before pressing; for depositing a decoration on a temporary support (for example on a steel belt, or canvas, or other), on which support the base powders (atomised or similar) will be spread so that the decoration is face-down.

[0003] Dry decoration using powders is at present done using flat silk-screening machines, similar to those used for liquid glazes, or using rotary machines which generally use cylindrical silk screens, again similar to those used with wet glazes.

[0004] Known rotary machines, which as they are rotary are the only machines enabling a continuous-feeding type of operation, do not adapt well in general to use with dry-powder decorations.

[0005] Another problem is that the rotary machines are structurally limited in that the cylinders have to be as long as the pattern which is to be transferred onto the support.

[0006] This represents a considerable operating limitation in the use of rotary machines.

[0007] The main aim of the present invention is to provide an apparatus which distributes powders on a support according to a predefined pattern, overcoming the drawbacks inherent in the prior art.

[0008] The invention has the advantages of being simple as well as easy to apply on production lines.

[0009] These aims and advantages and more besides are all attained by the object of the invention, as it is characterised in the appended claims.

[0010] Further characteristics and advantages of the present invention will better emerge from the detailed description that follows of some preferred but non-exclusive embodiments of the invention, illustrated purely by way of a nonlimiting example in the accompanying figures of the drawings, in which:

figure 1 is a schematic lateral view in vertical elevation of a first embodiment;

figure 2 is a schematic lateral view in vertical elevation of a second embodiment;

figure 3 is a schematic lateral view in vertical elevation of a third embodiment; figure 4 is a partial schematic section made according to line I-I of figure 1.

[0011] With reference to the figures, 1 denotes a mobile rest plane constituted by a usual conveyor belt which supplies the supports 2, for example tiles or slabs, with a continuous straight motion.

[0012] An applicator head 3 is located above the conveyor belt 1, for applying the powders according to the predefined patterns onto the underlying supports 2 trans-

siting on the conveyor belt 1.

[0013] The applicator head 3 comprises a moving surface in effect a belt 4 bearing a plurality of small perforations arranged in a predefined pattern and of such dimensions that determined quantities of the powders can pass through them. The moving belt 4 is in effect the equivalent of a silk screen.

[0014] The moving belt 4 is a ring-wound non-stretch belt supported and driven by a pair of motorized pulleys 6 which are solidly mounted coaxially on a rotation axis which is parallel to the conveyor belt 1.

[0015] A special laser technique is preferably used to make the holes in the moving belt 4. This laser technique enables a very high level of precision to be obtained, and a resulting high definition in the final powder distribution.

[0016] The ring-wound moving surface 4 is tensioned between the motorised pulley pair 6, between which pulley pair 6 a fixed support drum 11 (on which the belt 4 drags) is interposed, as is a distributor organ 7 having the task of conveying the powders to the internal side of the belt 4.

[0017] The belt 4 is driven by the pulleys 6 which for this purpose are externally equipped with projecting radial pins 16, which insert in special slots 14 made at equal distances in the edges of the belt 4.

[0018] The slots 14 are elongate in the direction of motion. In the illustrated embodiments the slots 14 are elliptical, guaranteeing optimum operating precision.

[0019] Special means for controlling supply of powders to the applicator head 3 comprise a powder supplier-batcher 8, located above the distributor organ 7; the supplier-batcher 8 is activated according to the level of powders inside the applicator head 3 and on the belt 4, with respect to a predetermined level.

[0020] The measurement of this level is taken using a sensor system, schematically denoted by 9.

[0021] The supplier-batcher 8 is activated to discharge powders internally of the applicator head 3 when the sensor system 9 signals that a lower limit has been reached, while it stops discharging powders when the sensor system 9 signals that an upper limit level has been reached.

[0022] In a first embodiment, the supplier-batcher 8 is constituted by a continuous conveyor belt having a step operation. Discharge of the material is done laterally by effect of rotations of the conveyor about its own longitudinal axis, which rotations are achieved between one step and the next.

[0023] In a second embodiment, the supplier-batcher can be constituted by a prepacked cartridge which is very easy to insert and substitute.

[0024] In a first illustrated embodiment the distributor organ 7 is constituted by a doctor in the shape of a blade 17 which operates in direct contact with the internal side of the lower part of the perforated belt 4.

[0025] In a second illustrated embodiment, the distributor organ 7 is constituted by a sort of fixed double doc-

tor 27 which operates in direct contact with the internal side of the lower part of the perforated belt 4 and which identifies a central chamber for containing powders which is funnelled in a downwards direction to present a narrowed zone at which the powders are in contact with the internal side of the belt 4.

[0026] In a further embodiment the distributor organ 7 is constituted by a blade rotor 37 which is mobile in rotation about an axis which is parallel to the belt 4 and the rest plane, i.e. the conveyor belt 1.

[0027] In all of the illustrated embodiments the various distribution organs have the aim of favouring and regularizing the downwards expulsion of the powders through the perforations made in the belt 4.

[0028] Cleaning the patterned perforations in the belt 4 is done continuously by a suction effect exerted on the belt 4 by a plurality of suction mouths 5 located in the upper zone of the external cylindrical surface of the fixed support drum 11, the inside of which is kept depressed.

[0029] Usual actuating systems, not illustrated, are used for correlating the motion of the motorised pulleys drawing the perforated belt 4 and the supply motion of the conveyor belt 1.

[0030] This correlation, which also involves the synchronisation of the motion of the perforated belt 4 which a centred position of each single support 2 below the applicator head 3, determines a correct deposit of the powders on the support according to a predefined pattern.

[0031] Among others, the invention has the advantage that deposit of the powders is done by free fall, without any contact taking place between the belt and the underlying support.

[0032] A further advantage of the invention lies in the fact that it enables powders to be distributed according to predefined patterns on continuous belt supports, theoretically of infinite length.

Claims

1. An apparatus for distributing powders on a support in a predefined pattern, **characterised in that** it comprises:

a conveyor belt (1) for transporting the support (2);
an applicator head (3) for applying the powders, located above the conveyor belt (1), which head (3) comprises a belt (4) exhibiting a plurality of perforations set out according to a predefined pattern and being of such dimensions as to allow passage of determined quantities of the powders;
means for controlled supply of the powders to the head (3);
a motion of the perforated belt (4) being correlated with a motion of the conveyor belt.

2. The apparatus of claim 1 **characterised in that** the perforated belt (4) is ring-wound.

3. The apparatus of claim 2, **characterised in that** it comprises pneumatic means for continuously cleaning the perforations in the perforated belt (4): said pneumatic means comprising a plurality of suction mouths (5) afforded on an upper part of an external cylindrical surface of a fixed support drum (11), which drum (11) is interpositioned between two motorised pulleys (6) and supports the perforated belt (4): the suction mouths (5) being kept in direct communication with an inside of the drum (11) which is maintained in a state of depression.

4. The apparatus of claim 2 or 3, **characterised in that** the perforated belt (4) is driven by the two motorised pulleys (6), which pulleys (6) are coaxial and exhibit a common axis of rotation which is parallel to the conveyor belt (1).

5. The apparatus of claim 4, **characterised in that** the perforated belt (4) is tensed between the two coaxial motorised pulleys (6) and a distributor organ (7), which distributor organ (7) conveys the powders to an internal side of the perforated belt (4).

6. The apparatus of claim 5, **characterised in that** the distributor organ (7) is constituted by a fixed doctor in the form of a blade (17) which operates in direct contact with the internal side of the perforated belt (4).

7. The apparatus of claim 5, **characterised in that** the distributor organ (7) is constituted by a double fixed doctor (27) operating in direct contact with the internal side of the perforated belt (4); the double fixed doctor (27) identifying a central chamber for containing the powders which tapers in a downwards direction, defining a narrow zone in which the powders are in contact with the internal side of the perforated belt (4).

8. The apparatus of claim 5, **characterised in that** the distributor organ (7) is constituted by a radial-bladed rotor (37), also known as a star doctor, which is mobile in rotation about an axis which is parallel to the perforated belt (4) and to the conveyor belt (1).

9. The apparatus of claim 8, **characterised in that** the radial-bladed rotor (37) rotates in such a way that in a zone of contact with the internal side of the conveyor belt (1), the relative speed is not zero.

10. The apparatus of claim 5, **characterised in that** the motorised coaxial pulleys (6) are peripherally equipped with projecting radial pins (16) which insert in special slots (14) made at equal distances in

edges of the perforated belt (4); the special slots (4) being elongate in a direction in which the pulleys move.

11. The apparatus of claim 10, **characterised in that** 5
the projecting radial pins (16) are elliptical in shape.
12. The apparatus of claim 5, **characterised in that** the
means for controlled supply of the powders to the
head (3) comprise a supplier-batcher (8) of the pow- 10
ders, located above the distributor organ (7), acti-
vation of which supplier-batcher (8) is commanded
in accordance with a deviation of a level of the pow-
ders above the perforated belt (4) with respect to a
predetermined level thereof. 15
13. The apparatus of claim 12, **characterised in that**
the supplier-batcher (8) is constituted by a continu-
ous stepper conveyor belt; discharge of the pow- 20
ders being effected laterally by rotations occurring
between one step of the belt and a next about a lon-
gitudinal axis thereof.
14. The apparatus of claim 12, **characterised in that**
the supplier-batcher (8) is constituted by a pre- 25
packed cartridge.

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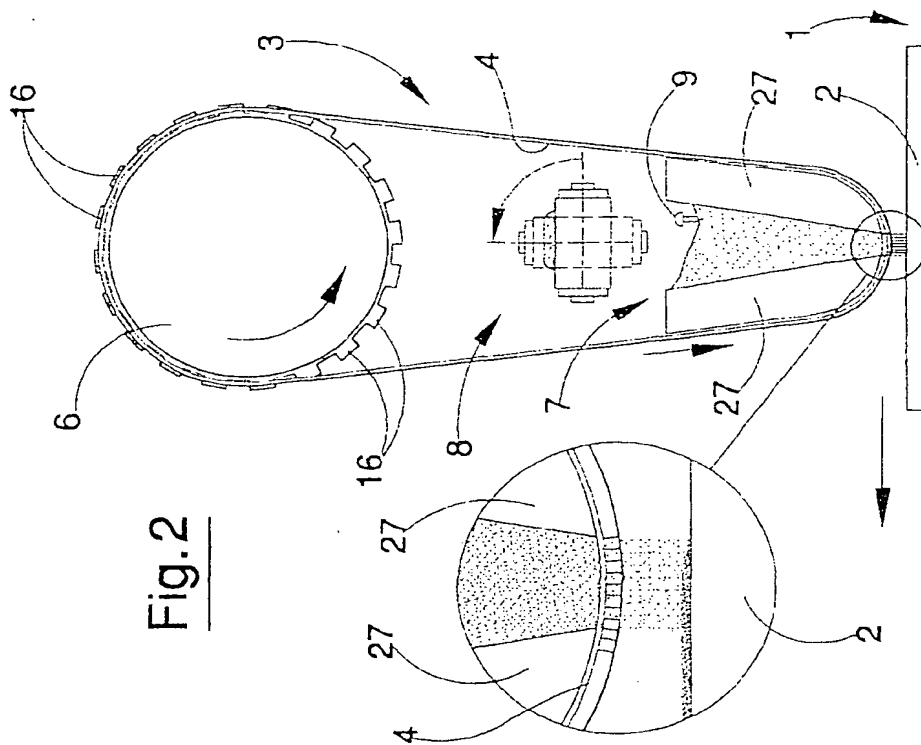


Fig. 2

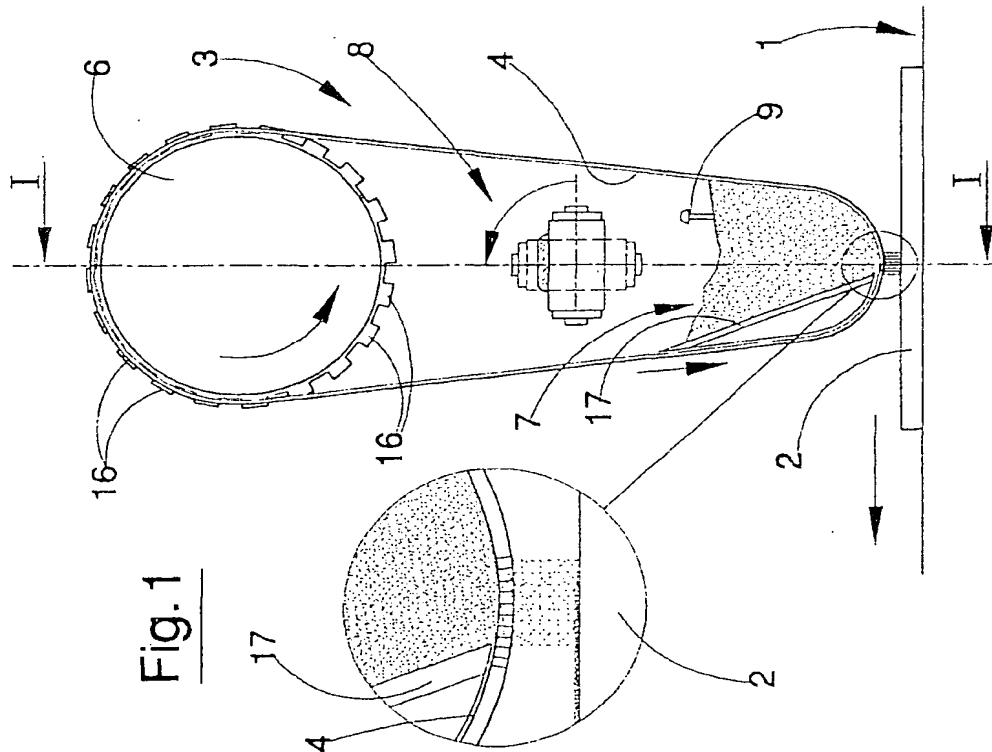
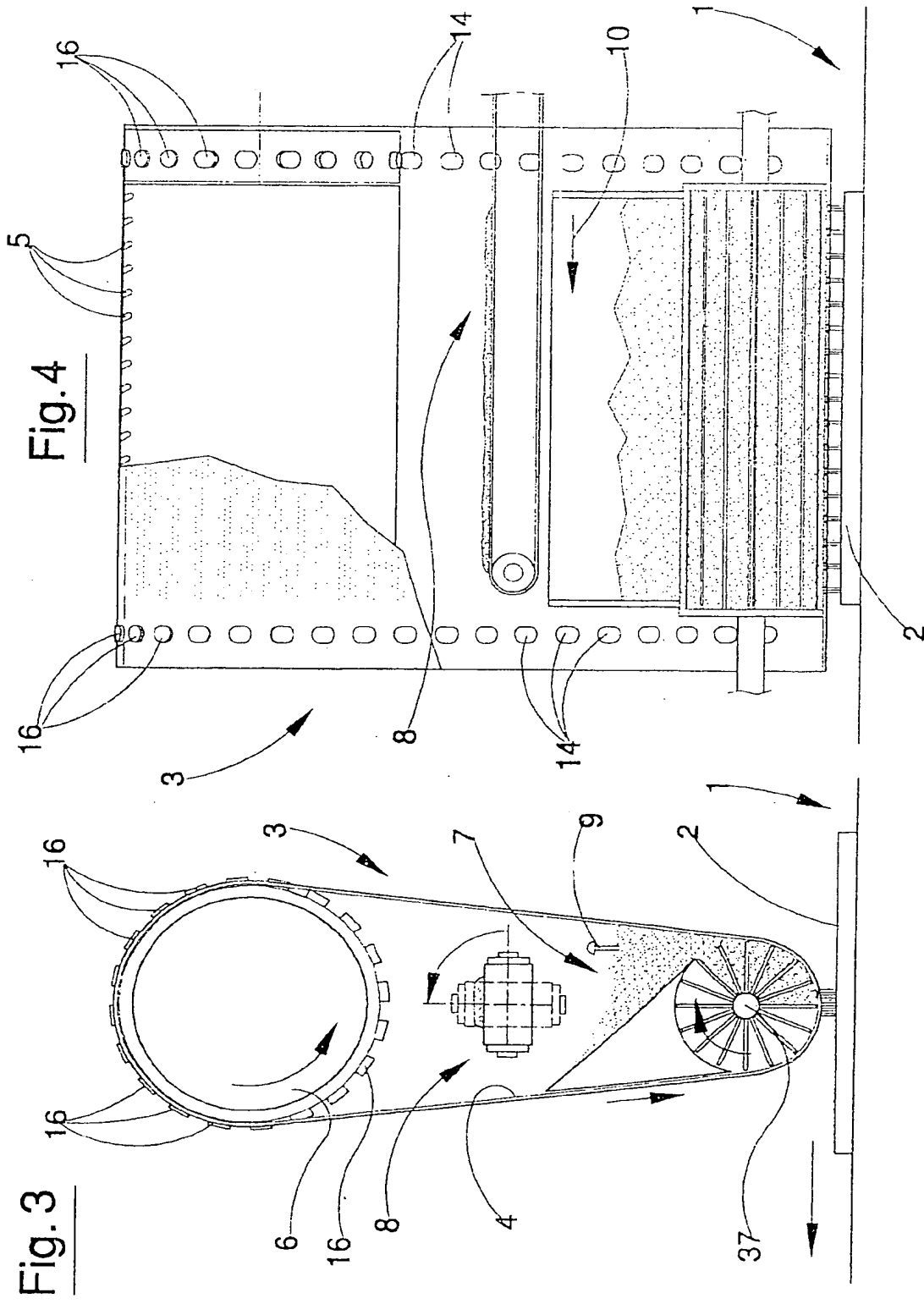


Fig. 1

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Application Number
EP 00 20 2044

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 October 2000	Examiner Gourier, P
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : technological background O : non-written disclosure P : intermediate document & : member of the same patent family, corresponding document	
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Application Number
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Place of search THE HAGUE		Date of completion of the search 10 October 2000	Examiner Gourier, P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons S : member of the same patent family, corresponding document</p>			

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